The WAAS Ionospheric Threat Model

L. Sparks and A.J. Mannucci,
Jet Propulsion Laboratory

T. Walter, A Hansen, J. Blanch, and P. Enge
Stanford University

E. Altshuler and R. Fries,
Raytheon

Navigation using the Wide Area Augmentation System (WAAS) requires accurate calibration of ionospheric delays. Large ionospheric irregularities do not pose a serious threat to safety as they can be identified easily by the WAAS irregularity detector and can be treated as manifestations of storm conditions (Walter *et al.*, 2000). The WAAS ionospheric threat model is designed to protect users against the worst-case threat posed by more modest irregularities that escape detection by the WAAS system. The threat model is derived from an analysis of data obtained from operational receivers in the WAAS reference station network under *non-storm* (or more precisely, *near-storm*) conditions. The *spatial* threat model, representing the *instantaneous* threat posed by undetected irregularities, is derived by systematically excluding some data from planar fits of vertical delay measurements within a neighborhood of each ionospheric grid point (IGP) and then using the excluded data to evaluate the maximum fit residual as a function of two metrics that quantify the spatial coverage of the measurements: (1) the fit radius encompassing the ionospheric pierce points (IPPs) of the measurements, and (2) the centroid of the IPP distributuion divided by the fit radius (this ratio characterizes the degree to which the IPPs are distributed uniformly across the fit region). The *temporal* threat model, representing the *growth* in fit residuals between fit evaluations, is derived by tabulating, as a function of time, the maximum difference between fit residuals at the time of a fit and fit residuals at subsequent times. We will present threat model results based upon data from eight distinct storm days during the year 2000.

Walter, Todd *et al.*, "Robust Detection of Ionospheric Irregularities" in proceedings of ION GPS, Salt Lake City, UT, September 2000.